

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization International Bureau



(43) International Publication Date
12 February 2004 (12.02.2004)

PCT

(10) International Publication Number
WO 2004/013261 A1

(51) International Patent Classification⁷: C10M 101/04, 129/68, 143/08 // B26D 7/08, A21C 15/04

(21) International Application Number: PCT/FI2003/000589

(22) International Filing Date: 1 August 2003 (01.08.2003)

(25) Filing Language: Finnish

(26) Publication Language: English

(30) Priority Data: 20021451 1 August 2002 (01.08.2002) FI

(71) Applicant (for all designated States except US): LAB-MAX OY [FI/FT]; Vesimäentie 2, FIN-15870 Hollola (FI).

(72) Inventor; and

(75) Inventor/Applicant (for US only): REPO, Harri [FI/FT]; Rautatienväylä 14 B 12, FIN-15110 Lahti (FI).

(74) Agent: TAMPEREEN PATENTTITOIMISTO OY; Hermiankatu 12 B, FIN 33720 Tampere (FI).

(81) Designated States (national): AE, AG, AI, AM, AT (utility model), AT, AU, AZ, BA, BB, BG, BR, BY, CZ, CA, CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (utility model), DE, DK (utility model), DK, DM, DZ, EC, EE (utility model), EE, ES, FI (utility model), FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NL, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK (utility model), SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SI, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidelines Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 2004/013261 A1

(54) Title: LUBRICATING OIL AND ITS USE

(57) Abstract: The invention relates to a lubricating oil, which is used in the food industry as the oil for, slicers and dividers, as lubricating oil for moulds and pans, or as a pan washing oil. The lubricating oil contains at least - turnip rapeseed oil or rapeseed oil as a main component, - auxiliary lubricant, which is selected from the following agents: - pharmaceutical grade white oil, - methyl ester (RME), ethyl ester (REE) or propyl ester (RPE) of turnip rapeseed oil or rapeseed oil, - emulsifier, which is selected from the following agents: - lecithin - acetic acid esters of mono- and diglycerides of fatty acids, - sucrose esters of fatty acids, - antioxidant, which is added synthetic tocopherol.

WO 2004/013261

LUBRICATING OIL AND ITS USE

The invention relates to lubricating oil for food industry and its use.

5

In addition to the typical characteristics of lubricating oil, the requirements for technical oils for food industry machines include compatibility with a food product, because depending on the lubricating target, oil can be entrained in a food product. Especially in slicer and divider oils, which are used for lubricating blades that cut the food product into smaller pieces, the lubricant comes into contact with the food product being processed. The abovementioned machines are used especially in bakeries for slicing bread, and as an example of these machines and the manners for lubricating their blades can be mentioned US patent 6,192,779, European patent 878 276, European patent 15380, German application publication DE 44 37 625 and European patent 312978.

20

For lubricating the abovementioned machines and other food processing machines, there has been an aim to develop "food grade" oils, which otherwise have the characteristics required from lubricating oils, such as viscosity and antioxidation and stability in process conditions. As an example of these, it is possible to mention US patent 6,087,308, wherein the oil is based on synthetics and is suited for machines, wherein oil may occasionally come into contact with a food product, as well as the oil presented in US patent 5,691,285, which is based on vegetable oils, such as corn oil, olive oil, coconut oil or peanut oil. US patent 4,753,742 presents oil suited for dough dividers, which is based on food-approved mineral oil (pure white mineral oil), to which lecithin is added. The use of oils containing large amounts of vegetable oils in this type of machines is criticized in the patent in question.

35

The German application publication DE 2904827 (Horst Groneweg) presents a cutting oil composition for slicers. The basis of the oil is animal or vegetable fat, for example a mixture of soybean oil or turnip rapeseed oil, and solid fine-grained fat or wax is added to it in order to

BEST AVAILABLE COPY

WO 2014/013261

PCT/FI2003/000589

2

form a film on the blade and to decrease friction between the blade and the bread.

Oils for slicers and dough dividers have been developed for 25 to 30 years by taking into account the device demands. Efforts have been made to provide a turnip rapeseed -based oil for slicers, mould lubrication and dividers, but the attempts have failed e.g. because of inadequate antioxidation.

In addition, especially for slicing bread, several technical characteristics are required of the oil in addition to food-approvability. Slicing finished bread is a procedure, wherein three materials are for a short time in interaction with each other: a moving metal blade, a thin oil film and the bread. In addition, the bread is aimed to be cut relatively shortly after baking, usually at a high temperature (40-60°C), which changes the characteristics of the oils being used too much into a harmful direction. The extent to which the bread sticks to the blade is also greater at higher temperatures. During dosage, the oil must spread evenly on the blade, it must have a good lubricity at the blade/bread boundary surface, the blade should wash itself in connection with cutting when the oil penetrates the bread, and the blade should remain free of the bread ingredients. The bread slices should also not be stuck together after slicing. Because spraying is a common oil dosage manner on the blade, it is desirable that the oil adheres well to the blade during spraying and no extra lubricating oil mist remains in the air.

For quite a while there have been combinations of different vegetable oils, waxes, lecithins and antioxidants on the market, which have been used as lubricating oils. The most well known manufacturer is the German Horst Groneweg GmbH & Co. KG with the trade name Dübör. The oils in question are classified as technical and not manufacturing oils, in which case declaration differs from a product used for food products. For example, antioxidants are not named and the source of lecithin is not indicated, nor are the E-codes.

WO 2004/013261

PCT/FI2003/000589

3

In the future, a perfect food compatibility will be required also from technical oils, because the main part of the use of the applications in question ends up as nutrition with the product.

5 A purpose of the invention is to disclose a vegetable oil-based lubricating oil, which can be used as lubricating oil in the food product industry, and all of whose components are compatible with food, but whose technical performance is also good, even in the very demanding cutting and slicing of just baked bread or other bakery product.

10

The invention is a turnip rapeseed oil or rapeseed oil based oil, which can be used especially in slicing bread and as dough divider oil, but also in greasing moulds and pans before baking and as pan washing oil in bakeries. The basis of the invention is a perfect compatibility with

15 food and a maximum functionality in applications.

By blending turnip rapeseed oil or rapeseed oil appropriately, a stable well-lubricating oil mixture is achieved, which at the same time functions as a well-spreading and metal-surfaces-washing oil by 20 utilizing the polarity and viscosity of turnip rapeseed oils and rapeseed oils – an advantageous viscosity/penetration change over a wide temperature area and also when the temperature increases. All this takes place without the vegetable oil polymerising in the abovementioned conditions, i.e. the non-polymerisation of this 25 component is characteristic to the composition.

The oil according to the invention includes the following components, which are discussed more in detail later:

30 — turnip rapeseed oil or rapeseed oil, including the mixtures of different oils,
— auxiliary lubricant,
— emulsifier, and
— antioxidant.

35 Different turnip rapeseed oil or rapeseed oil grades, whose purification degrees are different, can be blended with each other into an

WO 2004/013261

PCT/FI2003/000589

4

appropriate ratio in order to optimise lubricity, washing ability and dosage.

The lubricity of turnip rapeseed oil or rapeseed oil is not sufficient

5 without an auxiliary lubricant, which can suitably be a pharmaceutical grade white oil (synthetic), possibly supplemented with fractions of hydrogenated turnip rapeseed oil or rapeseed oil raffinates (stable turnip rapeseed oil raffinates Akorex L and Akorex C), as well as fatty acid methyl esters (RME), ethyl esters (REE) and propyl esters (RPE)

10 of turnip rapeseed oil or rapeseed oil. By means of the auxiliary lubricants a thin, even film of the oil can be formed on the blade, in which case the auxiliary lubricants function especially on the metal/oil contact surface.

15 The washability of the blades is achieved with emulsifiers, which can suitably be lecithins (E322), acetic acid esters of mono and diglycerides of fatty acids (E472a), sucrose esters of fatty acids (E473), or mono- and diglycerides of fatty acids (E471). In slicing bread, the water coming from the bread emulsifies into oil and functions as a

20 material washing the blade, and the oil moves from the surface of the blade into the bread during the cutting.

Antioxidation can be achieved by standardizing the tocopherol level of the product. An added tocopherol is more sensitive, functioning as a

25 fast antioxidant in operating conditions, whereas the natural tocopherol contained in turnip rapeseed oil or rapeseed oil improves the storage durability of the product.

Additional advantages can be provided with an aroma oil version, by

30 means of which the aroma of the sliced surface can be changed into, for example, garlic. Any desired fat-soluble food product aroma can be used in the invention. In this manner, the lubricant can be utilized in the aroma formation of a bread or other food product being cut, which gets into contact with oil, in addition to technical lubrication.

35 An example composition, wherein the portions of the components described later may vary within wide limits, is as follows:

WO 2004/013261

PCT/FI2003/000589

5

Turnip rapeseed oil or rapeseed oil: 80 to 99.7 weight-%

Auxiliary lubricant (e.g. pharmaceutical grade white oil): 0.05 to 10.00 weight-%

Lecithin (processed): 0.1 to 1.5 weight-%

5 Alfa-tocopherol (synthetic): 0.0001 to 0.001 weight-%

Gamma- and delta-tocopherol (synthetic): total 0.005 to 0.03 weight-%.

In the following are introduced the materials used in the oil composition according to the invention, the amount and characteristics of which are 10 discussed later. Some materials are substantial parts of the oil composition according to the invention, while others are supplemental and optional.

The materials used

15

1 a) Turnip rapeseed oil bases:

- Raffinatated (Mildola)
- SDG (Mildola), crude oil
- "Neito" (Mildola), raffinatated restrictedly

20

1 b) Turnip rapeseed oil fractions:

- Akorex (Karlshamns)

2) Lecithins:

- Stemphil grades (E322) (Central Soya)
hydrolysed lecithin with maximum
thermal resistance, release and
emulsification properties

3) Auxiliary materials:

30

- Citric acid (E330)
- Sorbic acid (E200)
- Propyl gallate (E310), Novakemia
- Butyl hydroxytoluene (BHT) (E321)
- Butyl hydroxyanisole (BHA) (E320)
- Tocopherols (E306), (E307), (E308), (E309)
- Pharmaceutical grade white oil (e.g.
polydecene), Fortum

35

WO 2004/013261

PCT/FI2003/000589

6

- Methyl, ethyl and propyl esters of turnip rapeseed oil (RME, REE, RPE)

4) Emulsifiers (other than lecithin):

5

- Mono- and diglycerides of fatty acids (E471)
- Acetic acid esters of mono- and diglycerides of fatty acids (E472a), Grünau
- Sucrose esters of fatty acids (E473), Sisterna

10

5) Aromas:

- Quest aroma agents (Biofincon Oy), (e.g. butter aroma)

15

The function of the turnip rapeseed oil or rapeseed oil component, of which there is typically at least 95 weight-%, advantageously at least 97.5 weight-% of the lubricating oil, is to function as the carrier of all other components and to lubricate the metal surfaces of the cutting blades by spreading over them quickly. This component consists, in a known manner, mostly of triglycerides of long chain fatty acids. As the base plants of the oils are turnip rape (*Brassica rapa* var. *oleifera*) and rape (*Brassica napus* var. *oleifera*), advantageously genetically non-engineered turnip rape or rape. The oil obtained from the seeds by pressing can be crude oil or more or less processed, in which case some components have been separated from it, e.g. lecithin. Turnip rapeseed and rapeseed oil are the most polar of vegetable oils, and they can be applied as lubricating oils spreading well on metal blades especially in dosaging taking place by misting. It has been noted that turnip rapeseed and rapeseed oil migrate well onto the surface of metal blades from a mist phase.

20

25

30

Aroma materials can be used, if necessary, to modify the characteristics of oil and to offer an aroma change in the finished product. From the point of view of technical functionality they are not essential.

WO 2004/013261

PCT/FI2003/000589

Antioxidation

Antioxidation is obtained by means of natural tocopherols and lecithins, as well as a synthetic tocopherol combination. Synthetic tocopherol is 5 sensitive and functions as a fast antioxidant in the slicing procedure. The natural tocopherol increases the storage durability of a product. The antioxidation of oil in storage can thus be maintained with an antioxidant contained inherently in the oil, which oxidates more easily than the double bond of the oil to be protected – gradually losing its 10 effectiveness at the same time. In addition to the oil type, the requirement is affected by the packaging being used and the storage conditions.

Ratio: (portions of synthetic tocopherols)

15	Alfa (E307)	5 to 10 %
	Gamma (E308)	40 to 65 %
	Delta (E309)	25 to 55 %

20 E306 = Tocopherol extract, which contains all the components E307 to E309.

25 There are a total of 0.005 to 0.03 weight-% of gamma- and delta-tocopherols, while the ratio between them can vary within the percentages described above. There is always alfa-tocopherol present in the tocopherols as well.

30 In the actual oil usage event the antioxidation is effected by a versatile assembly of requirements, which include higher temperatures, cutting forces, the water in the bakery product and other components of the dough, e.g. sugar. It has been detected that added synthetic tocopherol is more sensitive than the natural one. Synthetic tocopherols do not have an allergenic effect either, i.e. they are well suited for use with food products.

35 Citric acid is used in an amount of 25 to 100 ppm (25 to 100 g/ton of oil). The task of citric acid is adjusting the pH. It is also, however,

WO 2004/013261

PCT/FI2003/000589

8

possible to decrease oil oxidation with citric acid in connection with the cutting blade, and it has a synergy effect with other materials.

Propyl gallate is used in an amount of 50 to 200 ppm (50 to 200 g/ton of oil).

A pharmaceutical grade white oil functions as an important part of the lubricant composition, an example of which is polydecene (e.g. Neste Medical White Oil). Polydecene is also known by the English names hydrogenated polydec-1-ene, hydrogenated poly-alpha-olefin. The following table presents more detailed information of the product:

Typical analysis values	S22	S32	S46
Density kg/m ³ 15°C	820	825	830
Flash point °C (COC)	220	240	250
Pour point °C	-69	-60	-60
Viscosity index	130	135	135
Viscosity cSt/40°C	20	32	45
Viscosity cSt/100°C	4	6	8

Appearance: Clear, colourless and odourless oil.

Pharmaceutical grade white oil is used in an amount of 1000 to 5000 ppm (1000 to 5,000 g/ton of oil).

Pharmaceutical grade white oil is an inert synthetic lubricant, very pure (oxygen, nitrogen and sulphur compounds and aromatic compounds have been removed) liquid based on long-chain inert alkane hydrocarbons, which is characterized by odourlessness and colourlessness. This liquid functions in the composition as an auxiliary lubricant. It also contributes to release characteristics, as well as the blade coming off the bread and the bread slices not sticking to each other after slicing. As supplements of a synthetic auxiliary lubricant, also the processed turnip rapeseed oil Akorex L and/or Akorex C (Karlshamns) can be used as auxiliary lubricants, which can be used to "extend" the white oil. The materials in question are fractions of hydrogenated turnip rapeseed oil, which are obtained by separating the more solid fractions off when the temperature decreases. The

WO 2004/013261

PCT/FI2003/000589

9

remaining fractions, which are fluid in room temperature, are completely inert. Corresponding fractions can be obtained from rapeseed oil.

5 Another alternative for an auxiliary lubricant is turnip rapeseed oil or rapeseed oil methyl ester (RME), which is a methyl ester of turnip rapeseed oil or rapeseed oil fatty acids, obtained in the interesterification of a corresponding vegetable oil with methanol. It is possible to use turnip rapeseed oil or rapeseed oil ethyl or propyl ester
10 (REE, RPE) as well, which is obtained by interesterification with ethanol or propanol, respectively. These materials are also fluid in room temperature, in which case there is no problem of separation or particles during storage, which is a concern when using e.g. solid waxes.

15 An auxiliary lubricant is inert and oily in room temperature (20°C) and viscous enough. It can be more viscous in room temperature than the oil functioning as the main component. The auxiliary lubricant is used 0.1 to 2.0 weight-% in total in the lubricating oil composition.

20 At the boundary surface of metal and the product, a lubrication/release-characteristic, which prevents sticking, is to be created, as well as washing the metal surface, which takes place in connection with each product contact.

25 The primary task of lecithin is emulsification inside the oil – in such a manner that the antioxidant effects are maximized. A second task of lecithin is to function as a release material between metal and the product, as well as preventing the product slices from sticking. A third task of lecithin is to enclose metal particles into the film, which particles come off the chains, moulds and blades – thus, it ensures the prevention of the oxidation effects of metal ions, supporting the function of citric acid in the slicing procedure, which requires very fast protection. The fourth task of lecithin is to wash the metal surfaces by
30 utilizing the moisture of the food product.

35

WO 2004/013261

PCT/FI2003/000589

10

One possible lecithin is discussed in the following. Lecithin is hydrolysed lecithin, which has good release and emulsification properties and whose thermal resistance is advantageously at least 280 °C.

5

Sternphil HSB lecithin

Typical analysis values

Phospholipids	min. 30 %
Insoluble material	max. 0,1 %
Water	max. 1,0 %
Acid number	max. 20
Peroxide number	max. 3
Iodine number (10 %)	max. 40
Viscosity (mPa.s) 25°C	max. 200

10 Lecithin is used in the amount of 1000 to 15000 ppm (1000 to 15,000 g/ton of oil), while the optimum is 5000 to 10000 ppm. The values describe the processed (hydrolysed) lecithin added to the oil, the effect of which lecithin is more efficient than the inherent lecithin possibly remained in the oil.

15 The combined effect of lecithin, tocopherols and citric acid in the slicing event is as follows: an antioxidant, an ion catcher and an emulsifier, as well as the release effect.

20 In the following recipe table, some possible lubricating oil compositions are presented, which can be used in bakeries as slicer oils and dough divider oils, as well as mould oils. The doses are given in weight-%. Tocopherol is given as added synthetic tocopherol and lecithin as added processed lecithin.

25

WO 2004/013261

PCT/FI2003/000589

11

Raffinated turnip rapeseed oil	99.0539	88.8539	88.8739	99.6176	88.5293
"Neito"-oil	-	10.0000	10.0000	-	10.0000
Lecithin	0.8000	1.0000	1.000	-	0.8000
Citric acid	0.0200	0.0200	0.0200	0.0250	0.0220
Propyl gallate	0.0200	0.0200	-	-	0.0220
Polydecene	0.1000	0.1000	0.0500	0.0500	0.1000
Turnip rapeseed oil raffinate	-	-	0.0500	0.1000	-
Alfa tocopherol	0.0001	0.0001	0.0001	0.0002	0.0001
Gamma tocopherol	0.0030	0.0030	0.0030	0.0036	0.0033
Delta tocopherol	0.0030	0.0030	0.0030	0.0036	0.0033
E472a	-	-	-	0.1500	-
E473	-	-	-	0.0500	-
Aroma	-	-	-	-	0.5200

As a summary, the names of different materials, the E-codes and the manufacturers are provided in the table at the end. It is to be noted that the invention is not restricted to the materials coming from the manufacturers in question, but materials from other suppliers, which have the appropriate characteristics, can also be used.

Above, the use of oil especially as cutting oil in slicers is referred to, for which demanding environment the oil has the appropriate characteristics. The oil can also be used as the oil in the dough dividers separating the dough pieces at bakeries. In dough dividers, oil is used in lubricating mechanical parts, in which case it can occasionally be carried over to the dough as well, but also for lubricating the blades separating the dough pieces, in which case a contact with the food product is intentional. Similarly, lubricating oil can be used in lubricating moulds and pans and as pan washing oil, because thus it also comes between the metal and the food product before baking and e.g. its release properties can be utilized. When used as pan washing oil, the

WO 2004/013261

PCT/FI2003/000589

12

lubricating oil is used to wash the pan after the previous baking, in which case a lubricating film for the next baking remains on it at the same time. Bakeries are substantial users of oil also in these applications.

WO 2004/013261

PCT/FT2003/000589

13

Material	E code	Manufacturer
Raffinated turnip rapeseed oil		Middola
"Neito" turnip rapeseed oil		Middola
Lecithin 1		Stern Lecithin (Central Soya)
Hydrolysed lecithin with maximum thermal resistance, release and emulsification properties	E 322	
Citric acid	E 330	Algol
2-hydroxy-1,2,3-propane-tricarboxylic acid		
Propyl gallate	E 310	Novakemia
Polydecene		Fortum
Tocopherols		
Alfa tocopherol	E 307	Novakemia
Gamma tocopherol	E 308	
Delta tocopherol	E 309	
Turnip rapeseed oil raffinate		Karishamns AB
Akarex L		
Acetic acid esters of monoglyceride of fatty acids	E 472a	Grünau Illerisseen GmbH
Lamegin EE 190		
Sucrose esters of fatty acids	E 473	Sisterna B.V
Sucroles SP 50		

WO 2004/013261

PCT/FI2003/000589

14

Claims:

1. Lubricating oil, which is based on turnip rapeseed oil or rapeseed oils and is a slicer or divider oil, lubricating oil for moulds and pans, or pan washing oil for food industry, **characterized** in that it contains at least
 - turnip rapeseed oil or rapeseed oil as a main component,
 - auxiliary lubricant, which is selected from the following agents:
 - pharmaceutical grade white oil,
 - methyl ester (RME), ethyl ester (REE) or propyl ester (RPE) of turnip rapeseed oil or rapeseed oil,
 - emulsifier, which is selected from the following agents:
 - lecithin
 - acetic acid esters of mono- and diglycerides of fatty acids,
 - sucrose esters of fatty acids,
 - antioxidant, which is added synthetic tocopherol.
2. The lubricating oil according to claim 1, **characterized** in that the emulsifier is hydrolysed lecithin.
3. The lubricating oil according to claim 1 or 2, **characterized** in that the auxiliary lubricant is pharmaceutical grade white oil, possibly supplemented with inert fraction obtained from hydrogenated turnip rapeseed oil or rapeseed oil.
4. The lubricating oil according to any of the preceding claims, **characterized** in that
 - there is 0.1 to 1.5 weight-% of lecithin, advantageously 0.5 to 1.0 weight-%
 - the added tocopherol comprises gamma and delta tocopherols in an amount of 0.005 to 0.03 weight-% in total.

BEST AVAILABLE COPY

WO 2004/013261

PCT/FI2003/000589

15

5. The lubricating oil according to any of the preceding claims, characterized in that it contains citric acid.
5. The lubricating oil according to any of the preceding claims, characterized in that aroma material has been added to it as well.
7. The use of the lubricating oil according to any of the claims 1 to 6 as lubricating oil for slicers and dividers (machines that slice or divide food products) in the food industry, especially in bakeries.
- 10 8. The use of lubricating oil according to any of the claims 1 to 6 as lubricating oil spread by means of mist lubrication in slicers in the food industry.
- 15 9. The use of lubricating oil according to any of the claims 1 to 6 as lubricating oil of a blade of a bread slicer, in slicing bread which is at the temperature of 40°C to 60°C.
- 20 10. The use of the lubricating oil according to any of the claims 1 to 6 as lubricating oil for baking moulds or pans, or as pan washing oil, especially in bakeries.

BEST AVAILABLE COPY

INTERNATIONAL SEARCH REPORT

International application No.:

PCT/EP 03/00589

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: C10M 101/04, C10M 129/68, C10M 143/08 // B26D 7/08, A21C 15/04
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: C10M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, CAPLUS, WPI DATA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002006519 A1 (JAMES R. ANGLIN ET AL), 17 January 2002 (17.01.02), sections 0018, 0017, 0020 and 0021 --	1
A	US 4753742 A (ROBERT O. WILHELM, JR.), 28 June 1988 (28.06.88) --	1-10
A	US 5451334 A (FRANK BONGARDT ET AL), 19 Sept 1995 (19.09.95) --	1-10
A	DE 2904827 A1 (GRONEWEG, HORST), 14 August 1980 (14.08.80) --	1-10

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 November 2003	25-11-2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Dagmar Järvman/EÖ Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 03/00589

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0312978 A2 (GEBRÜDER HERLITZIUS GMBH & CO KG), 26 April 1989 (26.04.89)	1-10
A	DE 19721051 C1 (WABÄMA GMBH SPEZIALFABRIK FÜR SCHNEIDEMASCHINEN), 2 July 1998 (02.07.98)	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/FI 03/00589

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 2002006519 A1	17/01/02	NONE		
US 4753742 A	28/06/88	NONE		
US 5451334 A	19/09/95	BR 9007600 A	30/06/92	
		CA 2065011 A	18/02/91	
		DE 3927155 A	21/02/91	
		DE 59003632 D	00/00/00	
		EP 0486575 A,B	27/05/92	
		SE 0486575 T3		
		ES 2060193 T	16/11/94	
		JP 5503949 T	24/06/93	
		WO 9102784 A	07/03/91	
DE 2904827 A1	14/08/80	NONE		
EP 0312978 A2	26/04/89	AT 99122 T	15/01/94	
		DE 3735725 C	13/04/89	
DE 19721051 C1	02/07/98	EP 0878276 A,B	18/11/98	

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.